the Lewis glass, one skilled in the art would not look to combine such a highly alkaline composition with a cement to make a blended cement, as is called for in the claims.

Therefore, not only is there no fluxing agent taught in the prior art, particularly not in Lewis, but if the references were combined as suggested by the Examiner, the result would not be a reactive blended cement, but rather a mixture having no or inadequate cementitious properties. The result of the proposed combination would be a inoperative product and as a result the combination can not be made.

With the above amendments and remarks, this application is considered ready for allowance. Should the Examiner be of the opinion that a telephone conference would expedite prosecution of the subject application, he is respectfully requested to call the undersigned at the below-listed number.

Respectfully submitted,

WELSH & KATZ, LTD.

By Gerald T. Shekleton

Gerald T. Shekleton
Registration No. 27,466

Date: November 25, 1997

WELSH & KATZ, LTD.
120 South Riverside Plaza
22nd Floor
Chicago, Illinois 60606-3913
Telephone: 312/655-1500

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Section Heading: PORTLAND CEMENTS (continued)

Text:

Pyroprocessing. Nearly all cement clinker is produced in large rotary kiln systems. The rotary kiln is a highly refractory-lined cylindrical steel shell (3-8 m dia, 50-230 m long) equipped with an electrical drive to rotate at 1-3 rpm. It is a countercurrent heating device slightly inclined to the horizontal so that material fed into the upper end travels slowly by gravity to be discharged onto the clinker cooler at the discharge end. The burners at the firing end produce a current of hot gases that heats the clinker and the calcined and raw materials in succession as it passes upward toward the feed end (see under Clinker Chemistry). Highly refractory bricks of magnesia, alumina, or chrome-magnesite combinations line the firing end, whereas in the less heat-intensive midsection of the kiln bricks of lower refractoriness and thermal conductivity can be used, changing to abrasion-resistant bricks or monolithic castable lining at the feed end. To prevent excessive thermal stresses and chemical reaction of the kiln refractory lining, it is necessary to form a protective coating of clinker minerals on the hot face of the burning zone brick. This coating also reduces kiln shell heat losses by lowering the effective thermal conductivity of the lining.

It is desirable to cool the clinker rapidly as it leaves the burning zone. This is best achieved by using a short, intense flame as close to the discharge as possible. Heat recovery, preheating of combustion air, and fast clinker cooling are achieved by clinker coolers of the traveling-grate, planetary, rotary, or shaft type. Most commonly used are grate coolers where the clinker is conveyed along the grate and subjected to cooling by ambient air, which passes through the clinker bed in crosscurrent heat exchange. The air is moved by a series of undergrate fans, and becomes preheated to 370-800 DEGREES C at the hot end of the cooler. It then serves as secondary combustion air in the kiln; the primary air is that portion of the combustion air needed to carry the fuel into the kiln and disperse the fuel.

During the burning process, the high temperatures cause vaporization of alkalies, sulfur, and halides. These materials are carried by the combustion gases into the cooler portions of the kiln system where they condense, or they may be carried out to the kiln dust collector (usually a

fabric filter or electrostatic precipitator) together with partially calcined feed and unprocessed raw feed. This kiln dust is reusable. However, ASTM specifications limit the total SO3 content of the finished cement to 2.3-4.5%, depending upon the cement type and C3 A content. Similarly, an optional ASTM C150 specification limits the total alkali content of the cement to 0.60%, expressed as equivalent Na2O. Other potential and actual uses of dust include fertilizer supplements, acid mine waste neutralization, boiler SO2 control, and soil stabilization.

Wet-Process Kilns. In a long wet-process kiln, the slurry introduced into the feed end first undergoes simultaneous heating and drying. The refractory lining is alternately heated by the gases when exposed and cooled by the slurry when immersed; thus the lining serves to transfer heat, as do the gases themselves. Because large quantities of water (about 0.8 L/kg of clinker product) must be evaporated, most wet kilns are equipped with chains to maximize heat transfer from the gases to the slurry. Large, dense chain systems have permitted energy savings of up to 1.7 MJ/kg (1.6 TIMES 10**6 Btu/t) clinker produced in exceptionally favorable situations (47). The chain system also serve to break up the slurry into nodules that can flow readily down the kiln without forming mud rings. After most of the moisture has been evaporated, the nodules, which still contain combined water, move down the kiln and are gradually heated to about 550 DEGREES C where the reactions commence as discussed under Clinker Chemistry. As the charge leaves the burning zone it begins to cool, and tricalcium aluminate and magnesia crystallize from the melt and the liquid phase finally solidifies to produce the ferrite phase. The material drops into the clinker cooler for further cooling by air.

Dry-Process Kilns, Suspension Preheaters, and Precalciners. The dry process utilizes a dry kiln feed rather than a slurry. Early dry process kilns were short, and the substantial quantities of waste heat in the exit gases from such kilns were frequently used in boilers for electric power generation; the power generated was frequently sufficient for all electrical needs of the plant. In one modification, the kiln has been lengthened to nearly the extent of long wet-process kilns, and chains have been added; however, they serve almost exclusively a heat-exchange function. Refractory heat-recuperative devices, such as crosses, lifters, and trefoils, have also been installed. So equipped, the long dry kiln is capable of good energy efficiency. Other than the need for evaporation of water, its operation is similar to that of a long wet kiln.

The second major type of modern dry-process kiln is the suspension preheater system (50). The dry, pulverized feed passes through a series of cyclones where it is separated and preheated several times. The partially calcined feed exits the preheater tower into the kiln at about 800-900 DEGREES C. The kiln length required for completion of the process is considerably shorter than that of conventional kilns, and heat exchange is very good. Suspension preheater kilns are very energy-efficient (as low as 3.1 MJ/kg or 1334 Btu/lb clinker in large installations).

The intimate mixing of the hot gases and feed in the preheaters promotes condensation of alkalies and sulfur on the feed which sometimes results in objectionably high alkali and sulfur contents in the clinker. To alleviate this problem, some of the kiln exit gases can be bypassed and fewer cyclone stages used in the preheater with some sacrifice of efficiency.